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Fully Integrated On-Device Search and Web-Based Search Framework Incorporating Privacy Controls

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Abstract:

This publication describes a framework, implemented on a computing device, for integrating search results provided by a user device system-level search with internet-based search results provided by an internet search engine application, while retaining the privacy of a user of the device. The search results may be ranked based on both the user device system-level search and the internet search.

Keywords:

on-device search, internet-based search, user interface, rank, isolated process, operating system, privacy controls, search interface, system search, internet search engine application

Background:

Responsive to a search request from a user, a computing device may present search results provided by a user device system-level search (e.g., the computing device may provide a weather forecast based on a system-level search of the device in response to a user inputting "what is the weather today?" into a search field of a user interface on the computing device). A user may also perform a search by inputting a search query into an internet search engine on the computing device (e.g., the computing device may provide a weather forecast based on an internet search operated by an internet search engine in response to a user inputting "what is the weather today" into a search field of an application on the computing device).

In these examples, the search results from the user device system-level search are separate from the search results provided by the internet search engine. This lack of integration is problematic for users who desire to see the full range of both system-level search results and internet search engine results presented together in response to a single search query. User demand for a search experience integrating system-level search results with internet search engine search results has increased over time. Users value information privacy while simultaneously desiring increased relevancy for search results. However, maintaining privacy for system-level device information in an integrated framework with an internet search engine proves problematic without partitioning information from the internet search engine to ensure limited access.

Description:

Figure 1 illustrates a schematic representation of an integrated user device system-level search and internet-based search framework.
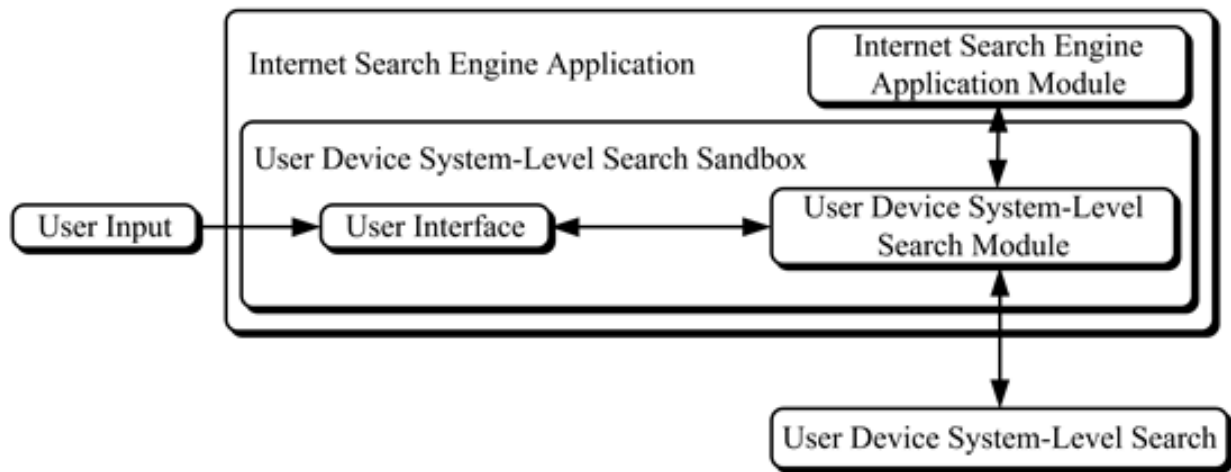

Figure 1

The framework includes a user interface located on a computing device. The user interface is capable of receiving user input (e.g., a user may input a search query into a search field on the user interface). The computing device includes a processor and computer-readable storage media (CRM), which stores instructions for a user device system-level search module. The user device system-level search module receives user input from the user interface as well as provides search results to the user interface. The user interface and user device system-level search module are located within a user device system-level search sandbox. The user device system-level search sandbox is located within an internet search engine application capable of performing internet-based searches. The internet search engine application includes an internet search engine application module for providing internet search results to the user device system-level search module. The user device system-level search module is in communication with a user device system-level search located on the computing device and partitioned separately from the internet search engine application to ensure information privacy.

For example, a user inputs a search query into a user interface on a computing device (e.g., a user inputs "what is the weather today?" into a search field of the user interface). The search framework as illustrated in Figure 1 enables combined user device system-level search and internet search engine results in a single user interface (e.g., the search results for a search query "what is the weather today" may be based on a combination of an internet search engine results and user device system-level results).

The framework retains the privacy characteristics of information on the user's device by utilizing the user device system-level search sandbox in an isolated process hosted by the internet-based search application separate from the user device system-level search. The internet search engine application has access to both on-device and internet-based data prior to ranking and

rendering the search results (e.g., the user is presented with search results in response to their initial search query and the search results are tailored to the user based on previous search queries). In aspects, search results may be ranked by the user device system-level search module based on a combination of user device system-level search and internet search engine information.

The user device system-level search module combines user device system-level results and internet search engine results as they arrive, thereby providing the added benefit of reducing latency otherwise introduced during processing. In aspects, the framework may retain privacy and decrease latency by running part of an autocomplete function for conducting searches in an isolated process within the user device system-level search.

The user device system-level search may be inaccessible to specific artificial intelligence-driven features for certain data to ensure ease of use by the operating system. Enabling specific artificial-intelligence-driven features may otherwise increase latency. By utilizing a user device system-level search sandbox rather than the system-level search, the framework ensures both a reduction in latency and increased privacy.

Benefits of integrating a system-level search with an internet search engine application include access to an internet search engine ecosystem of services. Services offered by the ecosystem allow for an enriched user experience and more nuanced search results that can be tailored to a particular user. By tailoring search results, a user's search experience may be more relevant (e.g., search ranking may more-accurately reflect a user's interest).

Further to the above descriptions, a user may be provided with controls allowing the user to make an election as to both if and when systems, applications, and/or features described herein may enable collection of user information (e.g., information about a user's search history, a user's preferences, a user's current location), and if the user is sent content and/or communications from

a server. In addition, certain data may be treated in one or more ways before it is stored and/or used, so that personally-identifiable information is removed. For example, a user's identity may be treated so that no personally-identifiable information can be determined for the user. In another example, a user's geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

References:

[1] Patent Publication: US20080250021A1. Method for Searching Private Data Via a Public Data Search Interface. Priority Date: September 08, 2006.

[2] Patent Publication: US20180121456A1. Aggregating Personalized Suggestions from Multiple Sources. Priority Date: April 22, 2013.